

Appendix C

Lock Hydraulic System Model and Prototype Study Data

C-1. Introduction

The availability of data from CE hydraulic model and prototype investigations of navigation lock filling/emptying systems, as summarized in Table C-1, is given in Table 1 of Item P5. This information was obtained from a detailed review of 81 reports on model and prototype studies (1937 to 1984) by STP, BHL, and WES. Those reports are listed in Appendix A. The organization and use of Table 1, Item P5, are described in the following paragraphs.

Table C-1
Lock Hydraulic System Model and Prototype Study Data

PAGE SEQUENCE FOR TABLE 1				
DESIGN AND OPERATIONAL VARIABLES	TEST REPORT COLUMN NUMBERS			
	01 TO 20	21 TO 46	48 TO 65	66 TO 90
11000 TO 11275	①	②	③	④
11300 TO 12290	⑤	⑥	⑦	⑧
12300 TO 13238	⑨	⑩	⑪	⑫
13240 TO 14180	⑬	⑭	⑮	⑯
14200 TO 15290	⑰	⑱	⑲	⑳
15300 TO 16260	㉑	㉒	㉓	㉔
16300 TO 16460 AND "NOTED ITEMS"	㉕	㉖	㉗	㉘
	FACING PAGES		FACING PAGES	

1. Select DESIGN and/or OPERATIONAL variable(s) of interest and note line number(s) (1100 to 16460).
2. Trace selected line(s) across appropriate tables and note which REPORTS (columns) contain TYPES OF DATA (T, O, Q, etc.) of interest.
3. See Appendix A for full titles of REPORTS.

C-2. Design and Operational Variables

A list of 251 hydraulic design and operational variables or significant features of navigation locks was derived from a review of such items in several kinds of filling/emptying systems used in CE locks. This list is organized in an upstream-to-downstream order and has a numbering sequence for easier manipulation in a digital computer. The major divisions of the list include:

- 11000 INTAKE SYSTEM
- 12000 FILLING VALVE SYSTEM
- 13000 CULVERT-CHAMBER MANIFOLD
- 14000 LOCK CHAMBER
- 15000 EMPTYING VALVE SYSTEM
- 16000 OUTLET SYSTEM

A listing of operational variables is included with each major division in Table C-1 rather than in a separate division in order to group more closely the aspects of the lock operation with their related design features. The 22 "NOTED ITEMS" lines include special items peculiar to the specific projects and are identified in the notes at the end of Table C-1.

C-3. Test Reports

Each column heading in Table C-1 includes a very brief identification of the project and a brief notation of the report number (full title in Appendix A). The reports are listed in chronological order of the report dates. The STP Report No. 46 contains six separate studies and is listed in six separate columns in Table C-1. This gives an apparent total of 86 reports. All the reports are available on loan from the WES Technical Library.

C-4. Types of Data in Reports

The types of lock performance data available in each report and pertaining specifically or generally to the various design and operational features investigated are indicated by the following letter symbols in Table C-1:

T = time, curves, and/or tabulation of lock chamber filling and/or emptying, or actual valve motion in a few tests

O = overfill or overempty in lock chamber

Q = culvert system discharge, or lock chamber rate-of-rise or rate-of-fall

H = hawser force on tow in lock chamber, or in approach in a few tests

D = tow displacement, unrestrained by hawsers

V = local velocities in ports, approach channel, etc.

C = surface currents, including vortices at intakes

B = boils, or surface turbulence

W = waves, or water-surface profiles in a few tests

S = surges or oscillations

I = internal flow pattern or flow distribution

Z = local average piezometric pressures

P = local transient or fluctuating pressures

L = pressure losses or differences

F = mechanical forces or torque

A = vibration

X = other data, usually air vent discharge.
See last line of NOTED ITEMS at end of Table C-1

C-5. Comments

The following comments result from observations during the compilation of Table C-1 and may be of interest and/or assistance to users searching for available test data pertinent to their design problems.

a. Consideration of both the design and operational variables of the feature under investigation, both more general and more specific identification of the variables, and related items or systems in Table C-1 may aid in finding data that might otherwise be missed.

b. The listing of operational variables at “division level” in Table C-1 and the compilation process may have resulted in some inappropriate entries of types of data relative to the design variables. This would most likely occur where a report table or illustration includes several kinds of design and operational variables.

c. Culvert roof pressures just downstream from a valve were considered pertinent to, and listed under, 12230 (15230) FILLING (EMPTYING) VALVE SYSTEM, FLOW PASSAGE, ROOF EL, although a different variable may have been the primary consideration.

d. Surface currents at the intakes are listed under 11150 INTAKE SYSTEM, APPROACH, VORTEX CONTROL, although the vortex control may have been by valve operation or other feature rather than modification of the intake system.

e. Variable 14000 LOCK CHAMBER was given data references for nearly every citation involving lock chamber filling and emptying times and/or rates, hawser forces, surges, etc. Although there may not have been any design variations within the chamber, it is a location of primary interest for most aspects of lock operation.

C-6. Detailed Test Data Listings

Individual test report listings of the data locations within the reports are given in Item P5. An example list is given in Table C-2. The LINE NO'S correspond to those 251 numbers assigned to the design and operation variables. The TYPE OF DATA symbols correspond to those given in paragraph C-4 above. The FORMAT symbols are:

T = numbered table

P = numbered photograph

D = numbered drawings (plates)

F = numbered figures (covers all illustrations in STP reports)

W = test paragraph (or page if unnumbered paragraphs) containing information not indicated by the tables, photographs, drawings, or figures.

Table C-2
An Example of the Detailed Data Listing

SORTED DATA FILE NO E01SP019									
DATE 10/15/85									
PROJECT: PICKWICK									
DETAIL:									
REPORT: STP 19									
MISC:									
ENTRIES 275									
LINE	TYPE OF	EXORDIT	LOCATION-IN-REPORT						
NO.	DATE--								
13241	I	F	10,11,12,16						68,69,75,76,77
13265	I	F	10,11,12,16						81,75
13330	I	F	18						50
13340	I	F	18						54,55
13350	I	F	19,20						54,55
	I	F	18,41,44,45,46,47						37
	I	F	19,20						54,55
	I	F	10,11						52,54,55
	I	F	18						54,55
	I	F	19,20						65,66,67,68
13370	I	F	29						41,42,43,44,45,46,47,48,49
14000	I	F	21,22,23,24,26,26,27,28,30,31						36,37,38
	I	F	32						70,71,72
	I	F	30,31,32						70
	I	F	24						74
	I	F	29						19,24,25
	I	F	30,31,32						73
14212	I	F	21						24
	I	F	22						41,42,43,44,45,46,47,48,49
	I	F	23						74
	I	F	24						19,24,25
	I	F	25						24
	I	F	26						71,72
	I	F	27						24
	I	F	28						24
	I	F	29						26
	I	F	30						27
	I	F	31						33,34
	I	F	32						33,34
	I	F	33						33,34
	I	F	34						33,34
	I	F	35						33,34
	I	F	36						33,34
	I	F	37						33,34
	I	F	38						87
	I	F	39						85,86,87
	I	F	40						33,34,82,84,88
	I	F	41						33,34
	I	F	42						33,34
	I	F	43						33,34
	I	F	44						33,34
	I	F	45						33,34
	I	F	46						33,34
	I	F	47						33,34
	I	F	48						33,34
	I	F	49						33,34
	I	F	50						33,34
	I	F	51						33,34
	I	F	52						33,34
	I	F	53						33,34
	I	F	54						33,34
	I	F	55						33,34
	I	F	56						33,34
	I	F	57						33,34
	I	F	58						33,34
	I	F	59						33,34
	I	F	60						33,34
	I	F	61						33,34
	I	F	62						33,34
	I	F	63						33,34
	I	F	64						33,34
	I	F	65						33,34
	I	F	66						33,34
	I	F	67						33,34
	I	F	68						33,34
	I	F	69						33,34
	I	F	70						33,34
	I	F	71						33,34
	I	F	72						33,34
	I	F	73						33,34
	I	F	74						33,34
	I	F	75						33,34
	I	F	76						33,34
	I	F	77						33,34
	I	F	78						33,34
	I	F	79						33,34
	I	F	80						33,34
	I	F	81						33,34
	I	F	82						33,34
	I	F	83						33,34
	I	F	84						33,34
	I	F	85						33,34
	I	F	86						33,34
	I	F	87						33,34
	I	F	88						33,34
	I	F	89						33,34
	I	F	90						33,34
	I	F	91						33,34
	I	F	92						33,34
	I	F	93						33,34
	I	F	94						33,34
	I	F	95						33,34
	I	F	96						33,34
	I	F	97						33,34
	I	F	98						33,34
	I	F	99						33,34
	I	F	100						33,34
	I	F	101						33,34
	I	F	102						33,34
	I	F	103						33,34
	I	F	104						33,34
	I	F	105						33,34
	I	F	106						33,34
	I	F	107						33,34
	I	F	108						33,34
	I	F	109						33,34
	I	F	110						33,34
	I	F	111						33,34
	I	F	112						33,34
	I	F	113						33,34
	I	F	114						33,34
	I	F	115						33,34
	I	F	116						33,34
	I	F	117						33,34
	I	F	118						33,34
	I	F	119						33,34
	I	F	120						33,34
	I	F	121						33,34
	I	F	122						33,34
	I	F	123						33,34
	I	F	124						33,34
	I	F	125						33,34
	I	F	126						33,34
	I	F	127						33,34
	I	F	128						33,34
	I	F	129						33,34
	I	F	130						33,34
	I	F	131						33,34
	I	F	132						33,34
	I	F	133						33,34
	I	F	134						33,34
	I	F	135						33,34
	I	F	136						33,34
	I	F	137						33,34
	I	F	138						33,34
	I	F	139						33,34
	I	F	140						33,34
	I	F	141						33,34
	I	F	142						33,34
	I	F	143						33,34
	I	F	144						33,34
	I	F	145						33,34
	I	F	146						33,34
	I	F	147						33,34
	I	F	148						33,34
	I	F	149						33,34
	I	F	150						33,34
	I	F	151						33,34
	I	F	152						33,34
	I	F	153						33,34
	I	F	154						33,34
	I	F	155						33,34
	I	F	156						33,34
	I	F	157						33,34
	I	F	158						33,34
	I	F	159						33,34
	I	F	160						33,34
	I	F	161						33,34
	I	F	162						33,34
	I	F	163						33,34
	I	F	164						33,34
	I	F	165						33,34
	I	F	166						33,34
	I	F	167						33,34
	I	F	168						33,34
	I	F	169						33,34
	I	F	170						33,34
	I	F	171						33,34
	I	F	172						33,34
	I	F	173						33,34
	I	F	174						33,34
	I	F	175						33,34
	I	F	176						33,34
	I	F	177						33,34
	I	F	178						33,34
	I	F	179						33,34
	I	F	180						33,34
	I	F	181						33,34
	I	F	182						33,34
	I	F	183						33,34
	I	F	184						33,34
	I	F	185						33,34
	I	F	186						33,34
	I	F	187						33,34
	I	F	188						33,34
	I	F	189						33,34
	I	F	190						33,34
	I	F	191						33,34
	I	F	192						33,34
	I	F	193						33,34

The LOCATION IN REPORT numbers and letters are those of the pertinent tables, photographs, drawings, figures, and/or paragraphs in that particular report.

C-7. Instruction

In addition to the indicated tables, photographs, drawings, and/or figures having data pertinent to a specific design and/or operational variable, the user should refer to those parts of the text where these data items are discussed. The comment in subparagraph C-5*b* above also applies to the detailed data listings. Also, variations in design and/or operational variables from table to table, photograph to photograph, etc., rather than in individual tables, photographs, etc., are covered by listings of all the related data item location numbers. The user should compare variables from item to item as well as in a single item.

C-8. Coverage

A total of 24,635 location citations was derived from a total of 2,816 single- or combined-item references (tables, photographs, drawings, figures, text) in the 86 reports (81 publications).

C-9. Project Data Listings

Listings of available dimensional and other descriptive data pertinent to the project designs investigated in the model tests also are given in Item P5. An example list is given in Table C-3. Entries of "XXXXX" indicate sub-headings; entries of "X" indicate confirmed nonapplicable items; and blanks indicate unavailable information. A definition list for the abbreviations is included in Item P5.

Table C-3
An Example of Project Data File Number (PLEGEND)

00001	PROJECT DATA FILE NUMBER (PLEGEND)	11870	PORT THROAT
00002	DATE 08/14/86	11871	WIDTH
00000	GENERAL INFORMATION	11872	HEIGHT
01000	PROJECT IDENTIFICATION	11873	TOTAL AREA
01100	PROJECT	11874	T. AREA/CULV. AREA
01200	DETAIL	11875	T. WIDTH/CULV. WIDTH
01300	REPORT	11300	TRANSITION CONDUIT
10200	WATERWAY	11310	LENGTH
10210	NAME	11320	SHAPE
10220	MILE	11330	UPSTR SIZE (UXH)
10230	PORT-DOCK NUMBER	11340	DNSTR SIZE (UXH)
10300	PROJECT DIMENSIONS	11350	SLOPE
10310	DESIGN LIFT	11360	BENDS
10320	MAX. LIFT	11370	NOTED ITEMS
10330	MIN. LIFT	11400	OPERATION
10340	USABLE LENGTH	11410	TYPE
10350	CLEAR WIDTH	11420	VALUES USED
10400	PROTOTYPE SYSTEM	11430	VALUE SCHEDULE
10410	INTAKE	11440	INITIAL POOL EL
10420	VALUES	11450	INITIAL CHAMBER EL
10430	FILL/EMPTY	11460	NOTED ITEMS
10440	OUTLET	12000	FILLING VALUE SYSTEM
10450	LOCK GATES	12100	VALUE
10460	EMERG. CLOSURE	12110	TYPE
10500	MODEL STUDY	12120	SIZE (UXH)
10510	TITLE (SHORT)	12130	RADIUS
10520	AUTHOR	12140	TRUNNION EL
10530	LABORATORY	12150	MOIST
10540	YES LIBRARY NO.	12160	VENTS
10550	REPORT DATE	12170	NOTED ITEMS
10560	TEST COMPL. DATE	12200	FLOW PASSAGE
10570	SCALE	12210	SHAPE
10580	SCOPE	12220	SIZE (UXH)
10590	NOTED ITEMS	12230	ROOF EL
11000	INTAKE SYSTEM	12240	INVERT EL
11100	APPROACH	12250	CONTRACTION
11110	CHANNEL TYPE	12260	EXPANSION
11120	CHANNEL LENGTH	12270	WELL
11130	GUIDE-GUARD WALLS	12280	BULKHEAD SLOTS
11140	DEBRIS CONTROL	12290	NOTED ITEMS
11150	VORTEX CONTROL	12300	OPERATION
11160	TRASH RACK	12310	TYPE
11170	NOTED ITEMS	12320	VALUES USED
11200	MANIFOLD	12330	VALUE SCHEDULE
11210	TYPE	12340	INITIAL POOL EL
11220	LOCATION	12350	INITIAL CHAMBER EL
11230	DESIGN SUBMERGENCE	12360	VENTS
11240	PORTS	12370	BULKHEAD SLOTS
11241	NUMBER	12380	NOTED ITEMS
11242	ARRANGEMENT	13000	CULVERT-CHAMBER MANIFOLD
11243	SHAPE	13100	CULVERT
11244	NOTED ITEMS	13110	LENGTH
11250	PORT FACE	13120	SHAPE
11251	WIDTH	13130	SIZE (UXH)
11252	HEIGHT	13140	AREA
11253	TOTAL AREA	13150	TRANSITIONS
11254	T. AREA/CULV. AREA	13160	BENDS
11300	PORT INTAKE	13170	NOTED ITEMS
11301	WIDTH	13200	MANIFOLD
11302	HEIGHT	13210	TYPE
11303	TOTAL AREA	13220	BRANCH LATS, LONGS
11304	T. AREA/CULV. AREA	13221	NUMBER
		13222	ARRANGEMENT
		13223	LENGTH